

10/529281
JC17 Rec'd PCT/PTO 25 MAR 2005

REPLY

To: Examiner of the Patent Office



1. Identification of the International Application

PCT/JP03/12771

2. Applicant

Name: CANON KABUSHIKI KAISHA

Address: 3-30-2, Shimomaruko, Ohta-ku, Tokyo

146-8501 Japan

Country of Nationality: JAPAN

Country of Residence: JAPAN

3. Agent

Name: TAKANASHI, Norimichi



Address: No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome,

Chiyada-ku, Tokyo 100-0005 Japan

4. Date of Notification: 15.06.2004

5. Subject Matter of Reply:

This is a reply to the first Written Opinion mailed June 6, 2004.

The applicant has amended the claims to make amended claims 1 to 10 as shown on the Amendment separately filed. (The applicant has replaced the amended claims filed on August 10, 2004 with amended claims 1 to 10 as shown on the Amendment separately filed.)

In amended claim 1, the multicolor light-emitting device has been limited to a multicolor light-emitting device comprising organic electroluminescence devices having at least "a first electrode which is a reflecting electrode, arranged on a side close to a substrate".

Further, in amended claim 1, the organic electroluminescence devices have been limited "among the organic electroluminescence devices a light-emitting region of at least one organic electroluminescence device which emits light of a color having a long wavelength is located at a position farther from the first electrode (reflecting electrode) than a position of a light-emitting region of at least another organic electroluminescence device which emits light of a color having a short wavelength".

Amended independent claim 1 having the above limitations is directed to a top-emission type light-emitting device (in

which a light-take-out portion is arranged on a side far from a substrate), which is different from a bottom-emission type light-emitting device (in which light is taken out through a substrate).

The device of the present invention has a specific effect that an optical path (optical path = $2nd$ (n : refractive index, and d : layer thickness) when seeing from the front side) of the device which emits light with a long wavelength can be made longer than an optical path of the device which emits light with a short wavelength to thereby increase the intensities of respective devices.

On the other hand, D1 (US2002-21268A) relates to an organic electroluminescence device.

Figs. 1(B) and 2A of D1 show a plurality of electroluminescence devices arranged in perpendicular and horizontal directions. In these drawings, numeral 202 denotes a hole-injecting layer; 106a, b, c denote light-emitting layers; 205 an electron-transporting layer; 206 an electron-injecting layer; and 201 a pixel electrode.

However, D1 does not disclose that the pixel electrode 201 is a reflecting electrode or a transparent electrode.

Since the pixel electrode 201 of D1 is in contact with the hole-injecting layer 202, it can be clearly said that the pixel electrode 201 is an anode. But, it is not clear whether

or not the pixel electrode 201 is a reflecting electrode.

Further, D1 discloses that the host material of a green light-emitting layer is CBP and the host material of a red light-emitting layer is DCM. CBP is a material having a high hole-transporting property, and DCM is a material having a high electron-transporting property.

However, D1 neither discloses nor suggests that respective light-emitting regions of different colors are made close to or far from the reflecting electrode for every color.

(If the light-emitting region of the red light-emitting device of D1 is arranged farther from a reflecting electrode, the reflecting electrode is located on a side far from a substrate and therefore must be used as an upper electrode. In this case, the light-emitting region of the green light-emitting device becomes close to the reflecting electrode as the upper electrode.

If the pixel electrode 201 in D1 corresponding a lower electrode is a reflecting electrode, the light-emitting region of the red light-emitting device becomes close to the the reflecting electrode.)

The present inventors' attentions were paid to charge-transporting performance (hole- or electron-transporting performance) of a host material, and at the first time the utilization of increasing optical interference has been applied to a top-emission type light-emitting device

to accomplish the present invention. Since it is not clear whether the pixel electrode 201 of D1 is a reflecting electrode, description of D1 does not state in such a manner that a skilled person in the art can carry out. Such description of D1 neither discloses nor suggests the features of the amended claims of the present invention.

As described above, it is considered that amended claims 1 to 10 possess novelty and inventive step.

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AMENDMENT

(amendment based upon the provision of Article 11 of the Law)

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146-8501 Japan

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Address: No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome,

Chiyada-ku, Tokyo 100-0005 Japan

4. Item to be amended: Claims

5. Subject Matter of Amendment

The applicant has amended the claims as shown on the attached replacement sheets. (The applicant has replaced the amended claims filed on August 10, 2004 with amended claims 1 to 10 as shown on the replacement sheets.)

(1) In amended claim 1, "a first electrode" and "a second electrode have been limited to "a first electrode which is a reflecting electrode, arranged on a side close to a substrate" and "a second electrode which is a transparent electrode, arranged opposite to the first electrode", respectively, based on original claim 3. Further, the "wherein ..." portion of claim 1 has been clearly amended to "wherein among the organic electroluminescence devices a light-emitting region of at least one organic electroluminescence device which emits light of a color having a long wavelength is located at a position farther from the first electrode than a position of a light-emitting region of at least another organic electroluminescence device which emits light of a color having a short wavelength", based on original claim 11, and supported by Examples 1 to 3 of the specification and Figs. 4A and 4B. Amended independent claim 1 is directed to a top-emission type light-emitting device.

(2) Amended claim 2 has been made based on original claims 2 and 3.

(3) Amended claim 3 has been made based on original claim

6.

(4) Amended claim 4 corresponds to original claim 7.

(5) Amended claim 5 corresponds to original claim 8.

(6) Amended claim 6 has been made based on specification,
in particular pages 22 and 23.

(7) Amended claim 7 has been made based on the
specification, in particular page 23.

(8) Amended claim 8 has been made based on the
specification.

(9) Amended claim 9 has been made based on original claim
16.

(10) Amended claim 10 corresponds to original claim 17.

6. List of Attached Documents

(1) Replacement sheets of pages 35 to 38

CLAIMS

1. (Amended) A multicolor light-emitting device comprising
a plurality of organic electroluminescence devices, the
5 plurality of organic electroluminescence devices emitting
lights of different colors, and each of the organic
electroluminescence devices having at least:

a first electrode which is a reflecting electrode,
arranged on a side close to a substrate,

10 a second electrode which is a transparent electrode,
arranged opposite to the first electrode; and

an organic compound layer arranged between the first
electrode and the second electrode,

wherein among the organic electroluminescence
15 devices a light-emitting region of at least one organic
electroluminescence device which emits light of a color
having a long wavelength is located at a position farther
from the first electrode than a position of a light-emitting
region of at least another organic electroluminescence
20 device which emits light of a color having a short
wavelength.

2. (Amended) The multicolor light-emitting device
according to claim 1, wherein the organic compound layer
has at least a stacked structure in which the light-emitting
25 layer is sandwiched between a first charge-transporting
layer and a second charge-transporting layer, and the first
charge-transporting layer is located on a side closer to

the substrate than the second charge-transporting layer.

3. (Amended) The multicolor light-emitting device according to claim 2, wherein the light-emitting layer of the one organic electroluminescence device has a property
5 of preferentially transporting holes;

the light-emitting layer of the another organic electroluminescence device has a property of preferentially transporting electrons;

the first charge-transporting layer is a
10 hole-transporting layer for preferentially transporting holes; and

the second charge-transporting layer is an electron-transporting layer for preferentially transporting electrons.

15 4. (Amended) The multicolor light-emitting device according to claim 2, wherein the thickness of the light-emitting layer is in a range of 10 to 35 nm.

5. (Amended) The multicolor light-emitting device according to claim 2, wherein a material and a thickness
20 of the first charge-transporting layer are the same as those for all of the organic electroluminescence devices.

6. (Amended) The multicolor light-emitting device according to claim 5, wherein a distance (dal) from the first electrode to the light-emitting region of the another
25 organic electroluminescence device is a distance obtained by the following equation:

$$n_1 d_{a1} = \frac{\lambda_a}{4} (1 + 2i) \quad i = 0, 1, 2, \dots \quad (c)$$

wherein n_1 denotes a refractive index of the first charge-transporting layer, and λ_a denotes a peak emission wavelength of the another organic electroluminescence device.

7. (Amended) The multicolor light-emitting device according to claim 6, wherein a distance ($db_1 + db_3$) from the first electrode to the light-emitting region of the one organic electroluminescence device is a distance obtained by the following equation:

$$n_{b1} d_{b1} + n_{b3} d_{b3} = \frac{\lambda_b}{4} (1 + 2i) \quad i = 0, 1, 2, \dots \quad (d)$$

wherein n_{b1} denotes the n_1 , $db_1 = da_1$, n_{b3} denotes a refractive index of the light-emitting layer of the one organic electroluminescence device, and λ_b denotes a peak emission wavelength of the one organic electroluminescence device.

8. (Amended) The multicolor light-emitting device according to claim 1, wherein the one organic electroluminescence device is an organic electroluminescence device which emits light of red.

9. (Amended) The multicolor light-emitting device according to claim 1, wherein the plurality of organic electroluminescence devices are at least three organic electroluminescence devices which emit lights of red, green and blue, respectively.

10. (Amended) A display having the multicolor light-emitting device according to claim 1.

ATTENTIONS

1. Demand for copy of documents

Copy of the documents described in the international preliminary examination report and not described in the international search report.

An applicant can request the copy of these cited documents to the Japan Patent Office, however, National Center for Industrial Property Information (Japan Patent Office building 2nd floor) handles inspection and copying of official gazettes and copying of other document etc.

[Contact and Reference]

National Center for Industrial Property Information

〒100-0013

3-4-3 Kasumigaseki Chiyoda-ku Tokyo

(Japan Patent Office building 2nd floor)

(Official gazettes) Industrial Property Information Reference Department

TEL: 03-3581-1101 Ext. 3811,3812

(Others) Industrial Property Reference Materials Department

TEL: 03-3581-1101 Ext. 3831,3832,3833

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[Application Method]

- (1) As for Patent (Utility Model, Design) Gazette, the following points shall be defined clearly.
 - Types of patent, utility model, and design
 - Fiscal year and number of publication of application or publication of unexamined application (or patent number, registration number)
 - Necessary number of paper sheets
- (2) As for documents except for the gazette, the following points are required attention.
 - Be sure to attach the copy of the international preliminary examination report (which shall be returned).

[Application and Reference]

〒135-0016

4-1-7 Toyo Koto-ku, Tokyo

Sato Daiya Building

Foundation of Japan Patent Information Organization

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Copy Service section

TEL: 03-3508-2313

Note) The period for requesting the copy of the documents to Japanese Patent Office is set to 7 years from the international application date.

2. It is necessary to submit the copy of international application (except for cases of already transmitted from the International Bureau) and its prescribed translation, and to pay the national fee. Respective countries set different periods so as to be required attention. (See Treaty Article 22, Article 39, and Article 64 (2) (a) (i))